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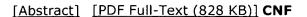
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Identifying repeating structural regularities in circuits allows the minimization of synthesis, optimization, and layout efforts. We introduce in this paper a novel method for identifying a set of repeating circuit structures, referred to as templates, and we report on using an efficient binate cover solver to select an appropriate subset of templates with which to cover the circuit. Our approach is comprised of three steps. First, the circuit graph is decomposed in a hierarchical inclusion parse tree using a clan-based decomposition algorithm. This algorithm discovers clans, grouping of nodes in the circuit graph that have a natural affinity towards each other. Second, the parse tree nodes are classified into equivalence classes. Such classes represent templates suitable for circuit covering. The final step consists of using a binate cover solver to find an appropriate cover. The cover will consist of instantiated templates and gates that cannot be covered by any templates. We describe the results of applying this algorithm to several circuits, and show that the algorithm is effective in extracting structural regularity.

Index Terms:

equivalence classes logic gates minimisation optimisation circuit layout CAD grammars trees (mathematics) regularity extraction clan-based structural circuit decomposition minimization optimization layout efforts templates binate cover solver hierarchical inclusion parse tree clan-based decomposition algorithm natural affinity equivalence classes structural regularity

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Abstract:

Automatic grouping and segmentation of images remains a challenging problem in computer vision. Recently, a number of authors have demonstrated good performance on this task using methods that are based on eigenvectors of the affinity matrix. These approaches are extremely attractive in that they are based on simple eigendecomposition algorithms whose stability is well understood. Nevertheless, the use of eigendecompositions in the context of segmentation is far from well understood. In this paper we give a unified treatment of these algorithms, and show the close connections between them while highlighting their distinguishing features. We then prove results on eigenvectors of block matrices that allow us to analyze the performance of these algorithms in simple grouping settings. Finally, we use our analysis to motivate a variation on the existing methods that combines aspects from different eigenvector segmentation algorithms. We illustrate our analysis with results on real and synthetic images.

Index Terms:

computer vision image segmentation eigenvalues and eigenfunctions matrix algebra automatic image grouping automatic image segmentation eigenvectors computer vision affinity matrix eigendecomposition algorithms stability block matrices algorithm performance synthetic images real images

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